DOCUMENT RESUME

ED 284 737 SE 048 282

TITLE	The Air We Breathe. Activity Packet.
INSTITUTION	Connecticut State Dept. of Environmental Protection, Hartford.
PUB DATE	[87]
NOTE	58p.
AVAILABLE FROM	Air Compliance Unit, Connecticut Department of Environmental Protection, 165 Capitol Ave., Hartford, CT 06106 (free).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Air Pollution; Conservation (Environment); Ecology; *Environmental Education; Natural Resources; Science Activities; *Science and Society; Science Education; *Science Instruction; Secondary Education; *Secondary School Science; Social Studies; State Curriculum Guides; State Government; Teaching Methods
IDENTIFIERS	*Air Quality; Connecticut

ABSTRACT

This packet of materials is intended to provide teachers with an interdisciplinary approach to integrating air quality education into the existing curriculum of Connecticut schools. The unit is designed to complement the student booklet "The Air We Breathe," which is included. A major portion of the document is comprised of teaching activities. The activities are divided into three sections. Each of the three sections begins with a reading assignment study sheet and contains one or more appropriate activities. These activities include the following topics: (1) Where does air pollution comes from? (2) Types of air pollution and their effects; and (3) What can we do about air pollution? Another section lists various resources available to teachers, such as media aids, school presentations and speakers' bureaus. Also included are sources for further information on air quality topics, bibliographies for teachers and students, individual activity evaluation forms, and a description of Connecticut's air pollution emergency plan. (TW)

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The Air We Breathe

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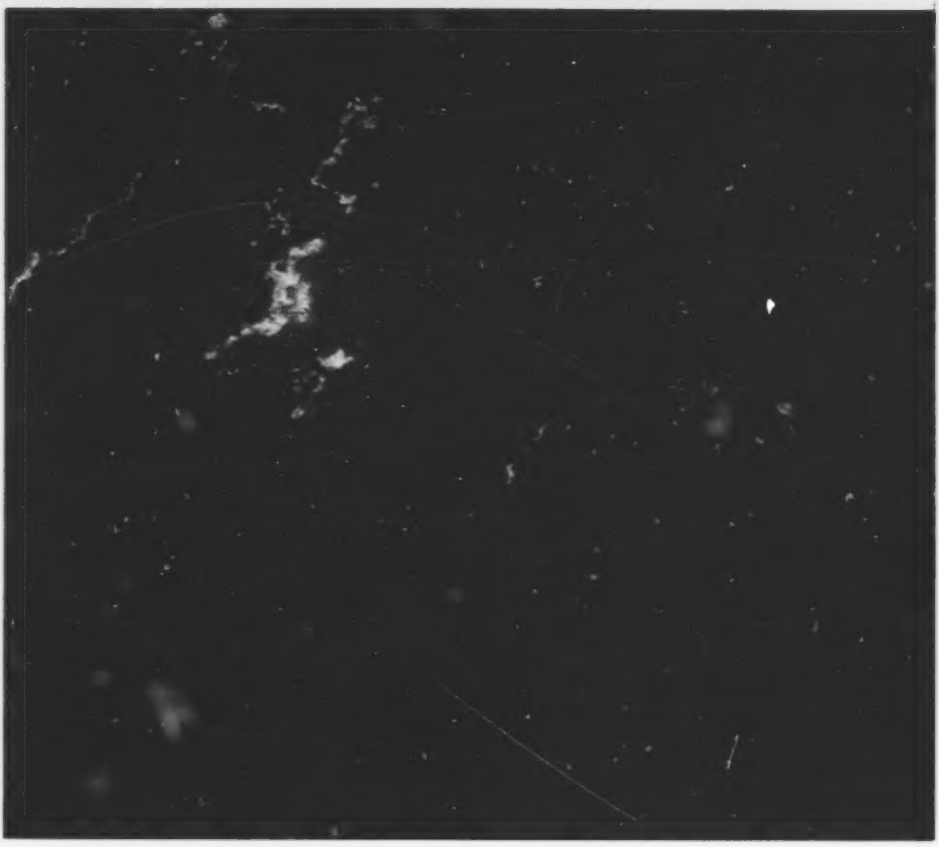


Clean Air-The Invisible Gift of Life.

Air is all around us. It surrounds the earth and fills up all the spaces that are not taken up with other things. Because we usually can't see it or smell it, it's easy for us to forget that it is there at all.

Air is mostly a mixture of two gases, nitrogen and oxygen. All animals need oxygen to keep living. Each of our body's cells is constantly burning oxygen, turning it into carbon dioxide, another gas.

Our blood acts as the transportation system

that carries oxygen to the cells and carries the carbon dioxide away again. When we breathe air into our lungs, the blood flowing there picks up the oxygen and takes it to other cells throughout the body. The blood also brings carbon dioxide back to our lungs, and from there the carbon dioxide leaves our bodies as we breathe out.

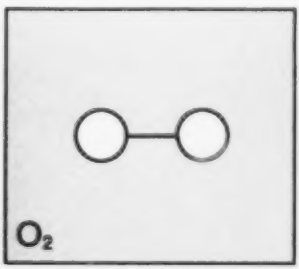
It isn't only the oxygen in the air that goes into our bodies as we breathe. Dirt and pollution in the air enter our lungs, too. That's one reason we want to try to keep the air as clean as we can.

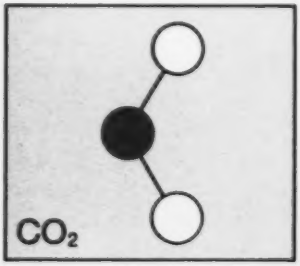
A hundred years ago, the air around the earth was clean. But then, in 1880, there were less than one and a half billion people living on the earth. During the last 100 years, our population has increased to over four billion.

While the number of people has been increasing, so has the number of machines we use. Since the industrial revolution, we've invented thousands and thousands of gadgets—cars and other vehicles, and many electric appliances. When we burn fuels to make these machines work, we also make air pollution.

Left: Every day, you breathe 3,448 gallons of air.

Right: The chemical symbols for oxygen (top) and carbon dioxide (bottom).





Where Does Air Pollution Come From?

Over half the pollution in our air comes from automobiles. Cars, trucks, buses and airplanes burn gasoline and other fuels to make their engines work. Fuels are made of chemicals, including carbon, hydrogen, nitrogen and sometimes sulfur. When we burn them, not all the chemicals are used. Some of the unburned elements combine to become hydrocarbons, which then become part of the pollution in our air.

As the fuels burn, they also give off different gases—carbon monoxide, sulfur oxides, and

nitrogen oxides—and particulates, bits of ash and dust that make the air look dirty and eventually land on the ground. Particulates can leave a layer of dirt on buildings and other things, and can get into "surface waters"—lakes and rivers that eventually become drinking water.

If engines were working at their best all the time, they would change most of the chemicals into carbon dioxide and water as they burn. These substances do not pollute the air, although too much carbon dioxide can also be harmful. In order to work this well, however, automobiles would have to travel without stopping all the time—something we know they cannot do. Cars that are not tuned properly use more fuel and also can add one third more pollution to the air than those that are adjusted to burn the fuel more completely.

Since there are more automobiles in the cities, the air in urban areas tends to get dirtier than the air in the country. Another reason the cities seem to sit under dirty clouds sometimes is that the automobiles traveling there must go more slowly and stop more often, so their engines burn the fuel less efficiently.

Not all the pollution in the air comes from cars, trucks, buses and planes. Whenever we burn fuels to make power, we also make chemicals that can pollute the air. Sulfur, nitrogen and dust can come from factories and power plants that burn coal and oil. About 20 percent of the pollution in our air comes from industry—factories where things are made. Another 15 percent comes from power plants that make electricity.

Burning fuel for power and landfill burning both put pollutants into the air.

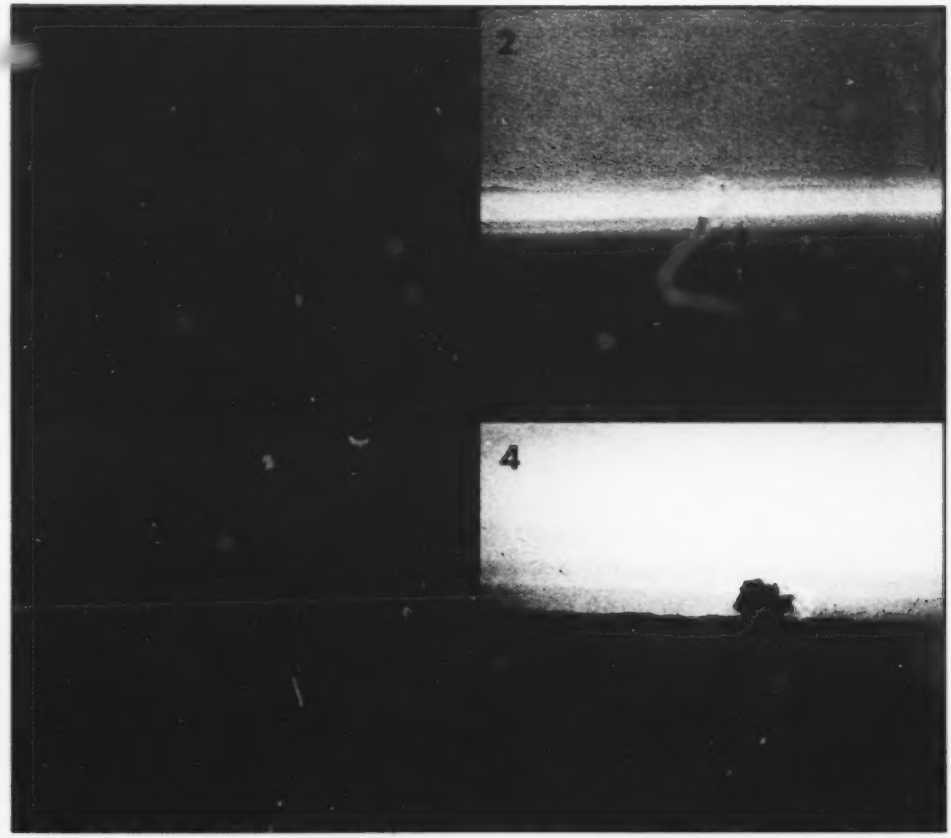
Types of Air Pollution and Their Effects.

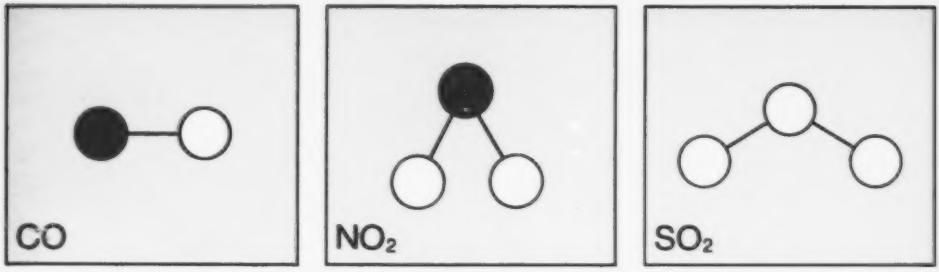
We can't see or smell **carbon monoxide,** but it can be one of the most deadly gases. It can drive the oxygen out of our blood, and without oxygen the cells in our bodies can't work and live. Breathing in a closed space filled with carbon monoxide can kill a person. In open spaces, too much carbon monoxide in the air can make us dizzy and tired and give us terrible headaches.

The **nitrogen oxides** in the air make a brown haze that can smell like chlorine in a swimming pool. These gases make our eyes and noses sting.

When the air stinks like a moldy, dusty

An inversion is created when a layer of cold air is trapped beneath a layer of warm air. Pollutants are thus trapped near the ground. In #3, a very hot plume forces its way through the inversion layer.





The chemical symbols for (l. to r.) carbon monoxide, one of the nitrogen oxides and sulfur dioxide.

room, we know it is polluted with **sulfur oxides.** These poisonous gases not only make our eyes, noses, and throats sting, they also can damage our lungs.

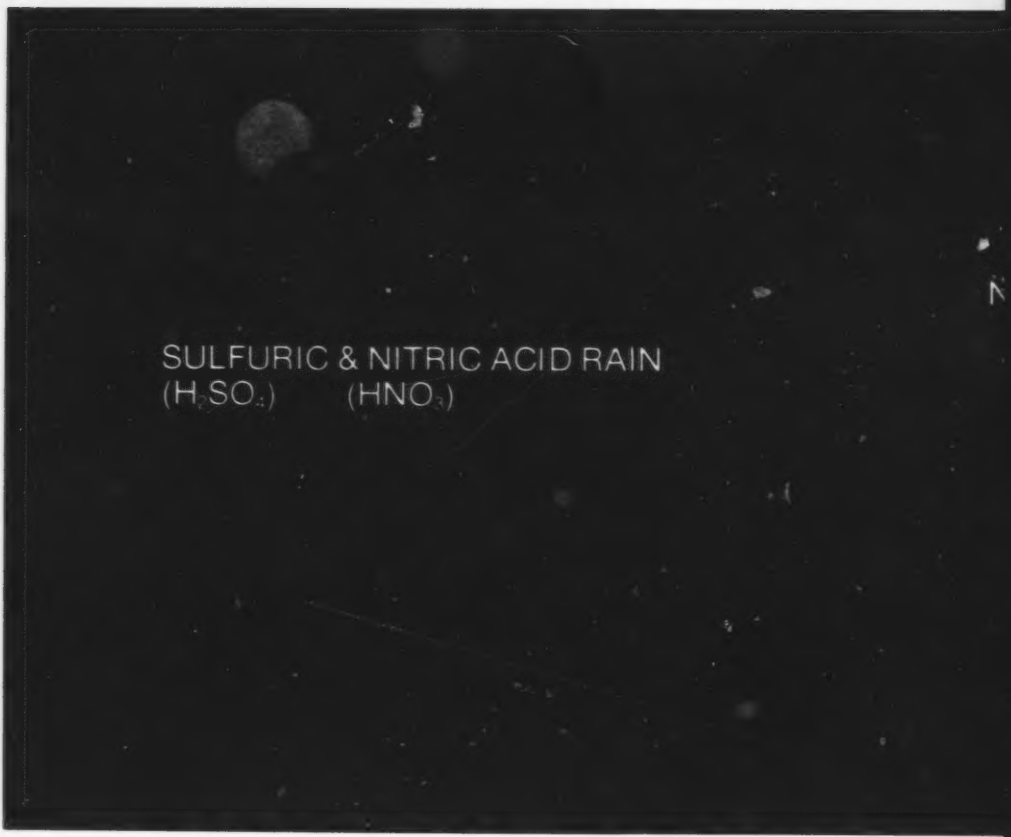
The ashes and dust in the air are called **particulates.** Sometimes they float around in the air, making it look grey, and sometimes they settle on the ground and make everything look dirty.

Some of the most harmful particulate pollutants are tiny pieces of **lead,** one of the metals used in making steel. Lead is put in some gasoline to make it burn more easily. We know that lead can cause damage inside our bodies—cramps and pains, as well as kidney and blood diseases, brain damage, blindness and even death. We might not get these diseases just from breathing lead particles in the air, but airborne lead particles that get caught in our lungs can make the effects of lead poisoning in young children who eat flaking paints containing lead even worse.

Children also sometimes eat lead particulates that have landed on objects and plants. This is particularly a problem in urban areas where there are a lot of cars.

Hydrocarbons are made from combinations of elements containing hydrogen and carbon. They are present in fossil fuels such as oil, gasoline, natural gas and coal. When they are not burned completely, they can escape into the air as gases, liquids and solids. We know some hydrocarbons, such as benzene, can cause cancer, and we think some others do, too. They escape into the air when fossil fuels don't burn completely, and also when petroleum products and paint thinners evaporate into the air.

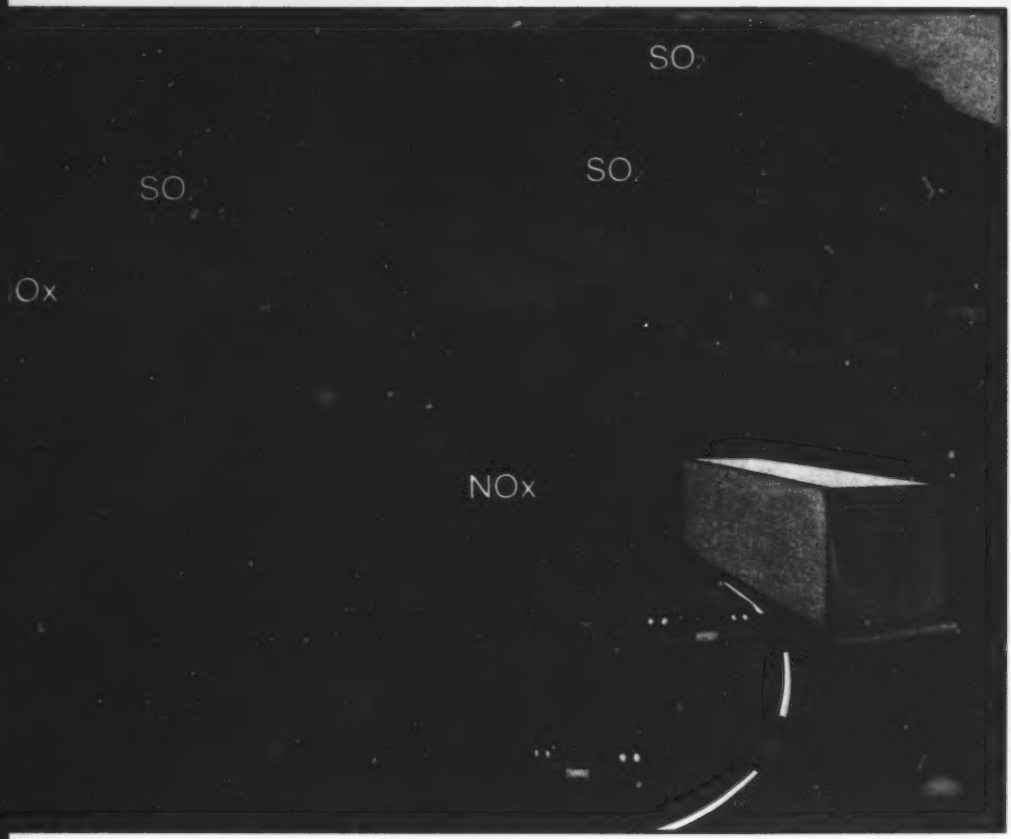
When the gases and particles stay in the air



for a long time, the sun can make them even stronger than they were and change them into other substances. When this happens, the hydrocarbon and nitrogen oxide pollution from our cars and industry smoke stacks becomes **ozone** which lowers our resistance to disease when we breathe it. It may also cause coughing, choking and headaches. Ozone can make rubber crack and damage fabrics, even making their colors fade.

In the air, sulfur dioxide and nitrogen dioxide mix with moisture to form sulfuric acid and nitric acid—substances that can burn just like the acid in a battery. When this moisture becomes precipitation, called **acid rain,** it can kill some plants and stunt the growth of others. It interferes with nature, changing the balance of lakes and rivers so fish and plants that used to live in them can't anymore. It also eats away at metal and stone, causing damage to man-made things

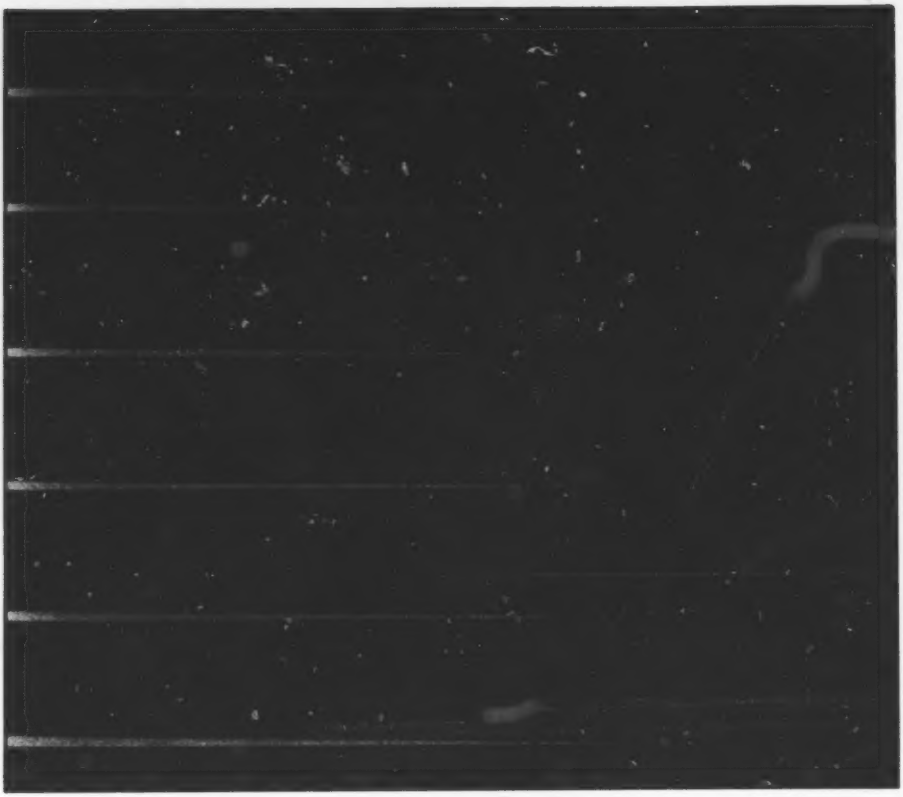
Acid rain has many sources and can seriously affect plant and animal life, as well as our water supplies.

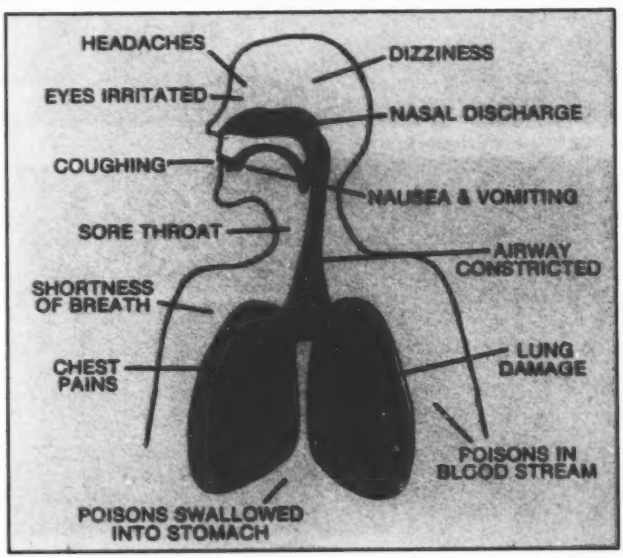


like buildings, bridges, and statues.

Too much carbon dioxide can be harmful because it doesn't allow the earth to cool. It traps the sun's infrared rays, keeping them from leaving the atmosphere once they've hit the earth. This makes what scientists call the **greenhouse effect** — warm air with a lot of moisture that can't escape.

Some of the pollution we breathe passes through our lungs and causes problems in other parts of our bodies. When they pollute the air, gases and chemicals like sulfur and carbon monoxide can make us feel nauseated and can keep our blood cells from doing their jobs. Some of the dust particles leave our lungs as we breathe out, but some of these particles may be trapped in the little air sacs in our lungs. After awhile, these trapped particles can damage our lung tissues and make it harder for us to breathe.





Top: The greenhouse effect prevents warm, moist air from escaping into the upper atmosphere.

Right: Common symptoms of irritation from pollution.

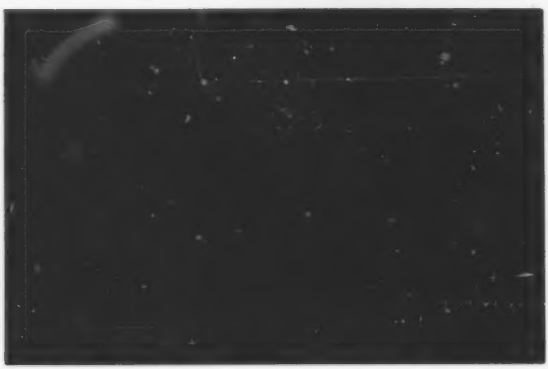
Besides affecting our eyes, noses, throats and lungs, air pollution helps make people with some diseases even sicker. People who suffer from lung diseases like emphysema, bronchitis, pneumonia, asthma and colds have even more trouble breathing when the air is polluted. Pollution has an even worse effect on old people and babies who have these diseases.

Besides hurting people and animals, air pollution can damage plants and property. Plants use carbon dioxide in much the same way animals use oxygen. Sulfur oxides, ozone, acid rain and other air pollution can burn the plants or keep them from getting as much carbon dioxide as they need to be healthy. Some scientists think that air pollution kills or hurts about $500 million worth of crops each year. It also is causing damage to forests, from California to Connecticut.

Some forms of air pollution also cause damage to property. Things that are made of fabrics, metals, stone and rubber are damaged by sulfuric acid and ozone in the air. Air pollution also helps make the paint peel off wooden things, like boats and houses. Some government officials think air pollution causes property damage costing $15 billion a year.

Left: Winter snows may have low pH values, contributing accumulated heavy doses of acidity to lakes, ponds and streams during thaw.

Right: Man-made structures are not exempt from effects of acid rain. Concrete, stone, paints, steel and other building materials can suffer accelerated corrosion and weathering due to air pollution.



What Can We Do About Air Pollution?

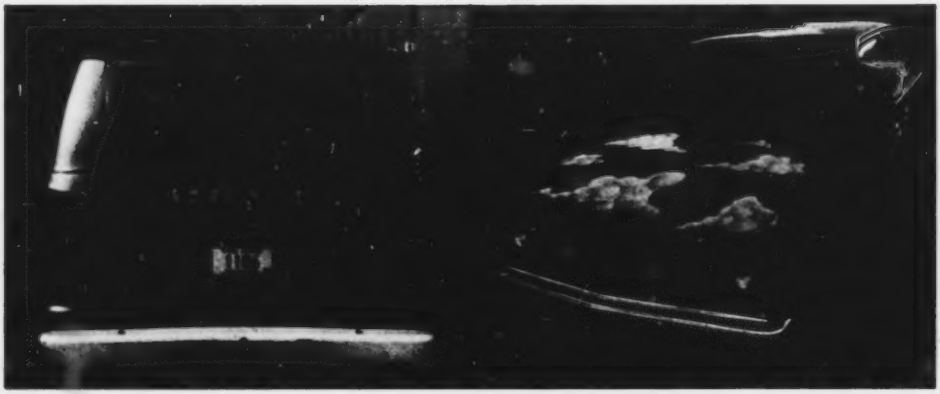
Air pollution is not the kind of problem that is just going to go away someday. If we don't start to do something about it now, it's only going to get worse. This is true in every country in the world.

In the United States, we have more cars and more industries than any other country. Our population is expected to increase from 225 million in 1980 to about 260 million by the year 2000. And, the number of cars here is increasing even faster than the number of people!

"More people" also means "more things"— things we need or want to make our lives more comfortable, things we need the resources and energy to make, and things that someday become wastes we must get rid of. We've learned to make things cheaply, but that also means they must be thrown away more quickly. We've learned it's easier to use things once and then throw them away, instead of making things well and the taking care of them so they will last a long time.

This "throw-away" lifestyle makes us burn more fuel to make more power to produce more goods and get rid of more wastes. And burning fuel and wastes helps add to the amount of pollution in our air. Sometimes, the factories that make things—metals and plastics, even paper—add other chemicals and fumes to the air, too.

So what can we do to stop wasting energy and



Car or van pooling (l.) and electrically powered cars (r.) are two ways of reducing air pollution.

stop putting pollution into the air?

Since automobiles put the most dirt into the air, we must find ways for them to make less pollution. We can make them burn less fuel by keeping them tuned properly, avoiding traffic jams, and driving less.

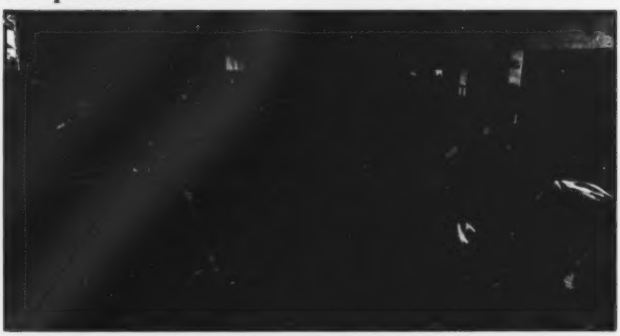
When we use less energy, we burn less fuel and we make less air pollution. Energy conservation can be the greatest friend clean air ever had.

We can conserve energy by taking the bus or train instead of driving sometimes. We can ride in carpools instead of having every person drive alone everywhere. If we're only going a few blocks, we can ride a bicycle or walk instead of driving a car.

There are many other ways we can save energy. We can turn the lights out when we don't need them. We can only use our heaters when it's too cold not to, and our air conditioners when it's too hot. We can add insulation to our buildings to make them more comfortable without having to use heaters and air conditioners.

We can also encourage businesses and industries to use cleaner kinds of fuels and to burn as little as they can.

We can send our garbage and leaves to the city or town landfill instead of burning them. And we can try to reduce the amount of wastes we send to the landfill by reusing things like glass, paper and metals, and by decomposing leaves and garbage into fertilizer in compost bins.



Connecticut's auto inspection and maintenance program is one way the state is reducing the amount of pollutants in the air.

We can tell our governments and industries that having clean air is important to us. If we do our part, they will keep doing theirs by finding new ways to make energy from cleaner sources of power, such as solar energy, and to control the air pollution from our factories and vehicles.

In the last ten years, our governments and companies have been doing research to find ways to make less pollution. Some of these "new technologies" include:

- burning gasoline that does not have lead in it. There are even some electric cars that use batteries we can recharge like a flash attachment for a camera.
- cutting down on the amount of pollution from industries and power plants that burn coal and oil. New kinds of filters can now be put on the smoke stacks to keep the poisonous gases and particles from going into the air.
- making power from cleaner sources. For instance, we've now found that we can make coal into natural gas, and burning natural gas does not make as much air pollution. We are also finding new ways to use water (hydropower), sun (solar energy), wind and tides to make power. We've even started making clean fuels out of our garbage!

All these efforts to find ways to keep our air clean will only continue if everyone helps. Can you think of ways you and your families can help clean the air?

Solar energy is just one alternative to more traditional power and heating sources.

Activities That You Can Do

Activity 1

What is the quality of the air in your neighborhood? You can probably check your daily newspaper for your local pollution standards index (PSI) which is usually included with the weather report. This index tells you how good or bad the air quality is for the day. You might want to make a chart showing the pollution levels in your area for a two week period. Are there any patterns? Why?

Activity 2

If you have any pictures that show air pollution, send them to us. And when you spot polluters, take their pictures and send them along also. We will check them out. Tell us where and when you took them. Be sure to include your name and address so we can write back to you.

Activity 3

Sign up for our mailing list. We will send you information on pollution prepared just for you.

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Activity Packet

Air Compliance Unit
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
165 Capitol Avenue
Hartford, Connecticut 06106

BACKGROUND

The Air Compliance Unit of the Connecticut Department of Environmental Protection (DEP) created this project with the development of the student packet "The Air We Breathe". At the same time, production of a dual projection sound/slideshow was begun. At this point, the need for a comprehensive set of lesson plans and student activities to compliment both the student booklets and the slideshow was realized.

In order to develop a unit of appropriate materials on air quality, an Education Advisory Group was formed. Through a series of brainstorming and editing meetings, which spanned six months' time, the group was able to produce this Unit.
Acknowledgement and thanks are due to all, and especially to those members who consistently gave of their time and expertise.
A complete list of the group's members follows:

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Dr. Robert Matthai
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Ms. Elizabeth Nord
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Ms. Margaret Richards
Connecticut Law Related Education
Connecticut Department of Education

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Manchester Center for Environmental Education

Mr. Robert Uerz, M.Ed.
American Lung Association of Connecticut.

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Particulate Trap
Visual Demonstration of Smog
Lake Acidity - Visual Demonstration
Greenhouse Effect
Health Effects of Air Pollution

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The Air We Breathe

The Air We Breathe

Clean air is a precious natural resource that cannot be taken for granted. Few people, however, are aware of the quality of our air and the effect that each of us can have on it. It is up to us to provide students with an awareness and understanding of air quality that enables them to make informed choices and decisions that will ultimately affect the air we breathe.

"The Air We Breathe" Education Packet is an innovative, interdisciplinary approach to integrating air quality education into the existing curriculum of Connecticut schools. The materials have been developed for use in grades 6-8.

This unit is designed to compliment the student booklet "The Air We Breathe". The activities provided, therefore, are intended as enrichment and expansion upon the basic principles set forth by the student booklets. The materials are arranged in the following format:

Activities - The activities are divided into three sections which correspond to portions of reading in the student books. Each of the three sections begins with a reading assignment study sheet and contains one or more appropriate activities.

Resources - This section lists various resources available to teachers such as media aids, school presentation and speaker's bureaus. Also included are sources for further information on air quality topics.

Bibliography - Bibliographies for students as well as teachers are listed.

Evaluation - Two types of evaluation forms are included in the packet. First, evaluation forms for individual activities are provided. These seek to obtain specific information about each activity that you use. A general evaluation form for the unit as a whole is also supplied.

How To Use This Packet

In General

The packet is designed to be used as a two-three week Unit comprised of daily sessions of approximately 45 minutes - 60 minutes. The skills that are being developed, such as graphing, mapping, mathematical averaging and paragraph writing, should be reinforced in the other content areas as the Unit progresses.

Integration with science lessons can be facilitated by utilizing the curriculum correlation provided. Get other teachers involved, share some of the activities with reading, math, or social studies staff members. The best possible application of this material is in a totally integrated learning situation.

In Particular

Reading Assignments - The reading of "The Air We Breathe" is divided into three sections. The activities are grouped accordingly. Each section contains a study sheet which gives the page numbers of the assigned reading, vocabulary words, and comprehension questions for that section. Student worksheets, suitable for reproduction are also included.

Activities - A variety of activities are provided to enrich your students' experiences with air quality. The activities are arranged in the order that related topics are dealt with in the student booklets.

Do all the activities if you have the time and resources. If not, you certainly may choose those activities which best fit your needs. Although subsequent activities may be used to build upon skills from previous ones, no activity requires the completion of another as a prerequisite.

Where needed, in-depth background material is provided for some of the activities. The predicted outcome of the activity is also supplied in cases where graphs or experimental observations are expected. Finally, related or follow-up activities are listed for those who may have extra time or accelerated students who need additional challenge.

Motivation

Resource Person

The beginning of a Unit on air quality affords an excellent opportunity to engage the services of one of the speakers listed in the Resources Section. The CT DEP - Air Compliance Unit has developed a dual projection sound/slide show which is used in combination with a speaker and display.

News Search

Another suggestion to spur student interest is to initiate a DEP - news article hunt. Inform students that you will be starting a Unit dealing with the environment and ask them to clip any articles which mention the CT DEP or the federal EPA. Students would gain a feel for what the Department is involved with and an understanding of how broad and diversified our environment is (air is just one aspect). These clippings could be used during the study unit as they become appropriate.

SECTION ONE

Where Does Air Pollution Come From? (pp. 1-4)

Vocabulary

Urban
Revolution
Appliance
Oxygen
Particulates
Carbon Dioxide
Efficient
Gadget

Questions

1. Why should we be concerned about air pollution? (2)
2. Where does over half of our air pollution come from? (3)
3. Where does the rest come from? (4)
4. In what ways do automobiles pollute our air? (4)
5. Why do cities tend to have dirtier air than rural areas? (4)

WHERE DOES AIR POLLUTION COME FROM?

Vocabulary

Urban
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Questions

1. Why should we be concerned about air pollution?

2. Where does over half of our air pollution come from?

3. Where does the rest come from?

4. In what ways do automobiles pollute the air?

5. Why do cities tend to have dirtier air than rural areas?

WHERE DOES AIR POLLUTION COME FROM?

Mapping Air Pollution

Objective

Students will be able to locate and identify sources of air pollution in the community. Students will be able to use a map key and determine the meaning of map symbols.

Time

One - two days.

Materials

Map
Drawing Paper
Markers
Chalkboard

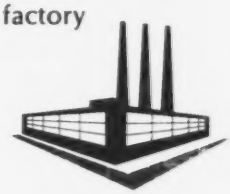
Procedure

Plan a route near the school for the students to walk that will include a variety of air pollution sources (traffic, bus routes, factory, school, incinerator, etc.). To prepare students for the walk you may wish to use a map from a classroom text to practice map-reading skills. Pass out a rough street map of the route to familiarize students with the route. Ask students to use their 5 senses (especially their noses, ears, and eyes) to locate air polluters. Remind students to make a key for their map and show direction. Students may make up their own symbols or you may want to use the following key:

highway

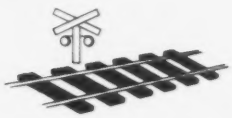
hills

factory



car

railroad



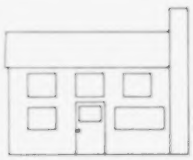
stream

bus or truck

open burning

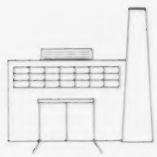
roadway

homes



airport

incinerator



trees

landfill

Lead students on the walk. While on the walk, have students draw and label landmarks and pollution sources along the way. Have them identify areas of high pollution.

For Example

Exhaust at traffic intersection
fumes on bus route
odors near factories
eye irritants from road dust

Back in the classroom, ask students to describe what they saw. Encourage use of descriptive vocabulary. Have students refer to "The Air We Breathe" to discuss what kinds of pollutants may have been emitted from the sources they discovered and charted.

Class Project

Have students draw a larger version of their air pollution map. With students using their individual air pollution maps as guides, fill in all the pollution sources and landmarks. You may want to color code the pollution sources according to type, and intensify the colors to rank severity. This could be displayed in the school's main hallway.

* If your school situation does not lend itself to this activity, you may want to set up a field trip to a nearby city. You may wish to combine this activity with a trip to a museum, state capitol, etc.

SECTION TWO

Types of Air Pollution and Their Effects (pp 5-10)
Study Guide

Vocabulary

Carbon Monoxide
Nitrogen Oxides
Sulfur Oxides
Hydrocarbons
Ozone
Acid Rain
Greenhouse Effect
Petroleum
Evaporate
Asthma

Questions

1. What health effects do nitrogen oxides and sulfur oxides have in common? (5,6)

2. What is one of the most harmful types of particulate pollution and why? (6)

3. Explain how hydrocarbons escape into the air. (6)

4. What is "acid rain"? Why is it a problem? (7)

TEACHER BACKGROUND

Greenhouse Effect

The buildup of pollutants in the atmosphere can cause an increase in its average temperature. One pollutant, carbon dioxide, is sent into the atmosphere in large quantities as a result of the burning of oil, coal and other fossil fuels. Wood burning also gives off large amounts of carbon dioxide. The rays of the sun pass through the atmosphere and strike the surface of the earth. The carbon dioxide prevents some of the heat from these rays from escaping back to space. As a result, the average temperature of the atmosphere is increased. This action is similar to the effect of the glass in a greenhouse. The glass allows sunlight to enter, but prevents some of the heat from the sunlight from escaping. This phenomenon is known as the "greenhouse" effect.

TEACHER BACKGROUND

Acid Rain

When airborne pollutants are transported through the atmosphere, some of the pollutants (such as SO_2 and NOx) combine with water vapor to form acids. These air pollutants are literally washed out of the air by rain, snow, and fog. Such precipitation is abnormally acidic.... thus the term "acidic precipitation", which is part of the more general process called "atmospheric deposition", during which other pollutants, such as heavy metals and toxic organics, fall to earth in both wet and dry weather.

Sulfur oxide and nitrogen oxide gases are emitted into the air from manmade sources such as power plants, industrial processes, cars and trucks. All these pollutants become part of the air masses circulating in the upper atmosphere, which flow predominantly into the Northeast. The industrial midwest is responsible for about half the sulfur dioxide emissions east of the Mississippi. The State of Ohio produces two times more tons of sulfur dioxide than all of New England, New York, and New Jersey put together. It is pollutants from these distant sources that contribute to damages in the Northeast environment.

Prevailing wind patterns subject the Northeast to transported air pollutants year round. Granitic bedrock geology and related soils leave large sections of the Northeast with little natural defense against acid precipitation. Lakes, streams, and drinking water supplies naturally low in alkalinity have little ability to neutralize the acid and buffer the effects.

The impacts of acid deposition, and acid precipitation in particular, are varied and often interrelated, creating complex and far-reaching consequences to both natural and manmade environments. Damage from acid precipitation has been well documented in the following major categories:

* Aquatic Ecosystems - fish species extinctions, decreased amphibian reproduction
* Terrestrial Ecosystems - reduction in tree productivity, leaching of nutrients
* Drinking Water Supplies - leaching of lead and copper from pipes
* Manmade Structures - accelerated corrosion and weathering
* Visibility - increased haze, decreased visibility
* Human Health - contaminated fish and water supplies

Because atmospheric deposition includes pollutants other than acid-forming ones, other serious impacts are also of concern in the Northeast. These include:

* accumulation of mercury or pesticides in fish
* accumulation of lead in soils
* Human death and disease from inhalation of sulfates and other fine particulates transported in the atmosphere.

TEACHER BACKGROUND

pH

The acidity of any solution is measured by its pH (potential (of) hydrogen) on a scale numbered from 0 to 14.

A pH of 7 is neutral. Solutions with a pH lower than 7 are acidic, while those greater than 7 are alkaline. Because the pH scale is logarithmic, a small difference in pH really means a large difference in acidity. A pH of 4 is ten times more acidic than a pH of 5, and 100 times more acidic than a pH of 6.

Unpolluted rain has a natural pH of about 5.6. A pH lower than this is considered abnormally acidic. In the Northeast, precipitation now has an annual average pH of 4.0 to 4.2. Individual storm events have been recorded at pH values well below this.

TYPES OF AIR POLLUTION AND THEIR EFFECTS

Study Guide

Vocabulary

Carbon Monoxide
Nitrogen Oxides
Sulfur Oxides
Hydrocarbons
Ozone
Acid Rain
Greenhouse Effect
Petroleum
Evaporate
Asthma

Questions

1. What health effects do nitrogen oxides and sulfur oxides have in common?

2. What is one of the most harmful types of particulate pollution and why?

3. Explain how hydrocarbons escape into the air.

4. What is "acid rain"? Why is it a problem?

TYPES OF AIR POLLUTION AND THEIR EFFECTS

Particulate trap

Objective

Students will be able to list and compare characteristics of particulate pollution around the school.

Time

1-week (intermittent observation)

Materials

Several glass slides per student
Petroleum jelly
Chart paper

Procedure

Cover several glass slides with a thin layer of petroleum jelly. Have students select three locations for their slides (variables should include height, proximity to chalk board, outdoor windowsills, peeling paint, etc.). Leave the slides in place for 1 week.

Construct charts similar to the one below and ask students to check their slides and fill in the chart*.

	Day 1	Day 3	Day 7	
Location 1				Color Size Possible source Special notes
Location 2				Color Size Possible source Special notes
Location 3				Color Size Possible source Special notes

Encourage students to be as descriptive as they can. At the end of 1 week collect the samples, being careful to label them by location. Have students share the slides with others to compare results. After students have completed their charts discuss the following: Which slides were cleanest? Describe them. Where were they placed? Which slides were dirtiest? Where were they placed? What role does location play in how dirty the slide is? What are the sources you think caused the particle pollution?

Related Activity

Based on their charts have the students write a report describing the slides and comparing the different results for each location. Ask students to give reasons for the differences and ask them to think of ways to prevent this particle pollution.

What to Expect

Dust and particulate matter will settle onto the slides. Slides located near chalkboards, peeling paint, or those set at levels near to traffic or particle-raising activity will probably contain more matter than those set elsewhere. You might try to identify the particles that are collected on the slides, by using a magnifying glass.

Visual Demonstration of Smog *

NOTE — THIS EXPERIMENT SHOULD BE PERFORMED AS A DEMONSTRATION BY THE TEACHER ONLY. DO NOT MIX THESE SUBSTANCES TOGETHER

Objective

Students will be able to describe how two seemingly unrelated chemicals react chemically to form smog.

Time

20 minutes

Materials

2 baby food jars
Bell jar **
Hydrochloric Acid
Household Ammonia

Procedure

Discuss odors, e.g., cigarette smoke, car exhaust, restaurants, boilers, skunk smell, etc.. Most of the odors cannot be seen but we are aware of them because of the chemical molecules that are carried in the air and enter our body. Some of the odors we like very much, others we don't like, and some are actually very harmful to us.

Indicate that you are going to conduct a demonstration that will make harmful odors visible to them. Explain that the situation is similar to how "smog" forms over many of our cities.

Place the two baby food jars on a table about two feet apart. Pour one inch of the hydrochloric acid into one jar and tightly cap the hydrochloric acid bottle. Add one inch of ammonia to the other baby food jar and tightly cap the original ammonia container.

Ask the students what they observe.

Explain that both jars are giving off fumes and toxins.

Slowly move the two baby food jars closer together until they are about two inches apart. By this time, a significant chemical reaction will have occurred with the fumes -- cover the demonstration with the bell jar to contain the fumes. Have students observe and discuss the results. Relate this to the formation of smog in cities.

Related Activity

This would be an excellent opportunity to introduce the concept of portmanteau words. For example, the students could brainstorm their own combination words and develop definitions for them.

* Smog = smoke and fog - term originated in London, England.
** An upside-down aquarium, large plastic sweater box or fabricated clear plastic chamber will work just as well.

Lake Acidity - Visual Demonstration

* This activity works very well after a pond study unit or in conjunction with it. Assume previous knowledge of acids/bases.

Objective

Students will be able to describe how increased acidity affects aquatic life. Students will be able to describe the logarithmic increase in acidity on the pH scale.

Time

25 minutes

Materials

4 glass jars (1 gallon size)
111 one-inch styrofoam balls painted red
10 pictures mounted on oak tag and strung in order to be worn around student's neck.
4 labels (7,6,5,4)

Procedure

Step 1. Place one glass jar on table in front of the class. Explain that it is a lake with a pH around 7. The lake has a number of animals living in it. Have 10 students go up and stand behind the table. Place an animal picture on each student.

Step 2. Place another jar beside the first. Mention that because of a change in air quality (increased pollution), the pH of the lake is changing. It changes to pH 6. Label the second jar 6. Indicate to the class that each number change in pH increases the acidity by a factor of ten. Therefore, the lake is now 10 times more acidic than it was when the pH was 7. Drop in one red styrofoam ball to indicate the new pH level.

Step 3. Ask the class how they think the new pH level will affect the lake. After some discussion mention that some organisms are very susceptible to changes in pH. Have the daphnia and the mussel sit down (these organisms have just died).

Step 4. Place another glass jar by the acidic lake. Poor air quality has increased acid deposition so that the lake again changes its pH. The new jar is labelled 5. Ask the students for the number of styrofoam acid indicators that you should place in the jar. The increase by a factor of 10 in acidity would require you to add 10 styrofoam balls to the jar. By this time, the students will realize that much of the animal life is going to be altered by the highly acidic lake. Have the following animals sit down: Mayfly nymph, BlueGill, Rainbow Trout, Spotted Salamanders, Bull Frog.

Step 5. Tell the students that unless the factors that were responsible for acid deposition can be removed from the air the lake will continue to become more acidic. Place the last jar on the table. Explain that some lakes in New York State have an acidity of pH 4. After receiving the correct answer from the students add the remaining 100 styrofoam balls to the "lake". At this point the Yellow Perch should sit down. The only remaining animals (Whirligig Beetle, Water Boatman) can easily fly to a new lake, as they often do.

Discussion

Discussion on the above lesson can take many forms. Some sample questions might be to:

- have students explain their feelings about the changes in the lake;
- how would the student feel if it was his favorite fishing spot or if his/her family had a cottage on the lake;
- who caused the acid deposition;
- what can be done to help correct the air quality problem;
- how much would they be willing to pay to help solve the problem, etc.

Susceptibility to Acidic Environment

This is a partial list of animals that are sensitive to acidic environment. It is suggested that pictures of these organisms be used in some acid rain lessons*.

Animals that Disappear

pH 6 - Grammus (Water Isopod), Daphnia, Mussels

pH 5 - Mayfly Nymph, Spotted Salamander, Crayfish, Tiger Salamander, Sunfish, Smallmouth Bass, Largemouth Bass, Rainbow Trout, Brown Trout, Walleye.

pH 4 - Lake Trout, Yellow Perch.

* Source of pictures: Ranger Rick Magazine, DEP Posters, any of a variety of outdoor magazines.

Greenhouse Effect

Objective

The students will be able to identify and graph temperature differences caused by the "greenhouse" effect.

Time

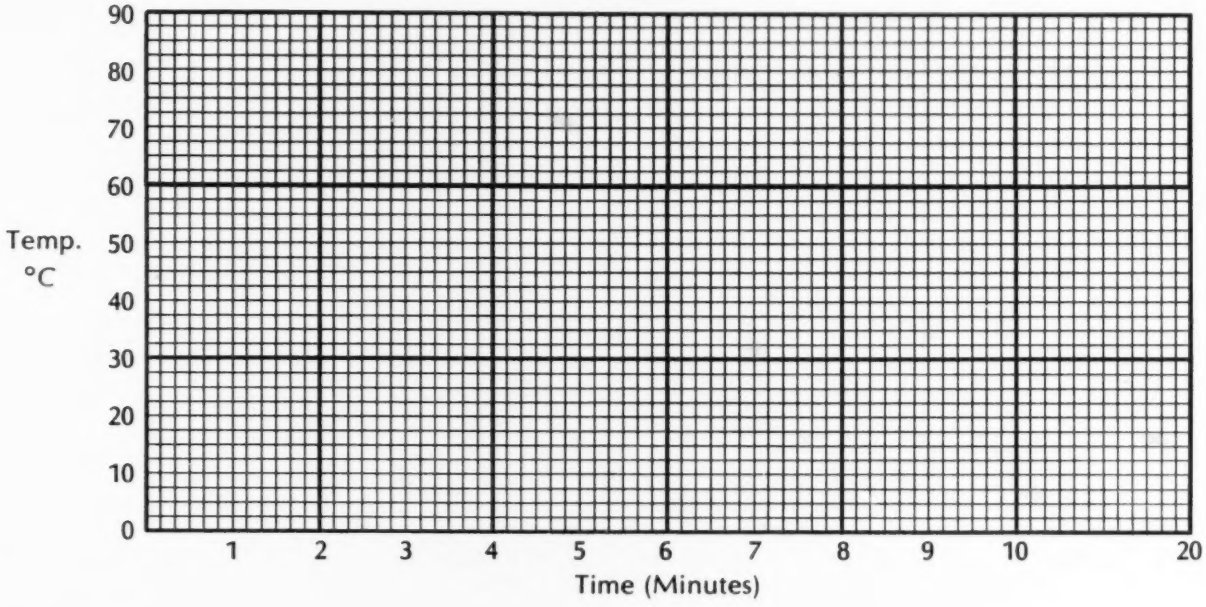
One class period

Materials

A terrarium or one-gallon glass jar with lid (cafeteria may have)
150-watt lamp
two thermometers (0-100° C.)
String
Clamps

Procedure

Place the 150-watt lamp on a clamp about 30 centimeters above a terrarium so that it shines on it. Place one thermometer outside the terrarium. Hang the second thermometer inside the terrarium, making sure that it does not touch the walls or the bottom. Wait five minutes and then record the temperature reading on each thermometer.
Now turn on the lamp. Record the temperature reading on each thermometer (outside temperature in red, inside temperature in green) at one minute intervals for ten minutes. Draw a graph of your data.
Now turn off the lamp and again record your data.



What to Expect

The temperature of the air in the covered terrarium or glass jar will be higher than the air outside the terrarium. After the lamp is turned off, the temperature will slowly begin to drop.

Health Effects of Air Pollution

Objective

Students will be able to identify and discuss some of the health effects associated with air pollution.

Time

One class session

Materials

Chalkboard

Procedure

Have students brainstorm a list of the health effects associated with air pollution. The list should include:

irritated eyes	cough
headache	sore throat
difficult breathing	etc.

Discuss the following questions:

What effect do you think air pollution has on healthy people?

What about persons who are not healthy? (high risk)

How many of you know a person who has a breathing problem?

What precautions do you think these persons should take on days when air pollution is very bad?

How do you know that the air pollution levels are high? (newspapers, TV news, etc.)

Introduce the "Pollution Standards Index", (found in Teacher Background, Section 3) and read "Emergency Episode" Plan excerpt (found in Section 5). Discuss.

Follow-Up

- Let students interview people that they know who are at high risk (asthma, lung disease, elderly, etc.). Information should include:

- Identify the reason they are at high risk.
- How do they feel on days when pollution is bad?
- What precautions do they take?
- Do they know about the PSI? And use it? etc.

or

Students may wish to do research on a breathing related-disease such as emphysema, bronchitis, asthma, etc.

SECTION THREE

What Can We Do About Air Pollution? (pp 11-14)
Study Guide

Vocabulary

Resource
Conservation
Insulation
Decompose
Compost
"Throw-away" lifestyle

Questions

1. What is meant by the term "Throw-away" lifestyle ? How does this relate to air pollution? (11)

2. The author lists about seven ways that we can stop polluting the air. Which of these do you think will have the greatest effect on improving air quality?(12) Which of these do you or your family already do?

3. Describe some of the new technologies that are reducing the amount of pollution that we put into the air.

4. Can you think of other ways to reduce air pollution?

TEACHER BACKGROUND

PSI

The Pollutant Standards Index (PSI), or Air Quality Index, as it is often referred to, is a report and a forecast of air pollution levels based on the measurement of ozone, sulfur dioxide, particulates and carbon monoxide. The Index reports the one pollutant of the four which reached the highest level in the preceding 24 hours and gives an "air pollution forecast" for the following day.

The Index is based on EPA's "Pollutant Standards Index" reporting system developed for use throughout the nation.

The Index is read in terms of four health labels, interpreted as follows:

GOOD -- No significant effects

MODERATE -- Some damage to materials, but human health not affected unless such levels continue for many days.

UNHEALTHFUL -- High risk individuals experience mild aggravation of disease symptoms. Those with lung or heart disease should reduce physical exertion and outdoor activity. Healthy individuals notice irritations.

VERY UNHEALTHFUL -- Lung and heart disease patients experience significant aggravation of disease symptoms and decreased exercise tolerance. These individuals and the elderly should stay indoors and reduce physical activity. Widespread symptoms in healthy individuals.

The index is reported daily in most major newspapers (usually as part of the weather section).

What Can We Do About Air Pollution?
Study Guide

Vocabulary

Resource
Conservation
Insulation
Decompose
Compost
"Throw-away" lifestyle

Questions

1. What is meant by the term "Throw-away" lifestyle? How does this relate to air pollution?

2. The author lists about seven ways that we can stop polluting the air. Which of these do you think will have the greatest effect on improving air quality? Which of these do you or your family already do?

3. Describe some of the new technologies that are reducing the amount of pollution that we put into the air.

4. Can you think of other ways to reduce air pollution?

WHAT CAN WE DO ABOUT AIR POLLUTION?

Air Pollution Graphing

Objective

Students will be able to describe Connecticut's Air Quality picture via the Air Quality Index. Students will be able to plot and interpret graphs.

Time

Two days.

Materials

Graph paper.
Handout of Air Quality Data (Ozone Levels April-Sept., 1982)

Procedure

Review general graphic concepts at board (X and Y axis, plotting, labeling, etc.). Present examples of both numeric and semantic labels for axes.

Handout graph paper and Air Quality Data Sheet. Read over material with students. Ask,"How could you set up a graph for this material?". (Possible answers -- numerical value for axes, health label for axes, etc.). Let students choose their own formats. Begin with plotting and check progress. Assign the rest for homework.

Next Day - Have students compare different formats. Which worked well? Which didn't? Discuss the use of graphs to highlight what you want people to perceive from them. Discuss use of graphs for propaganda. Ask students to give examples.

Have students study their graphs for trends. Are there any? Have students draw inferences about the weather conditions in a given period based on what they have learned about ozone formation in "The Air We Breathe".

Related Activities

Have students make a large graph for the classroom. Establish a rotating schedule for students to plot the daily Pollution Standards Index (from evening newscast or daily newspaper). Chart the readings for the year. This could become your "data base" for future lessons.

Using a map of Connecticut, have student represent levels of air pollution by color-coding areas near monitors according to numerical values of pollution. For instance, increments of .10 could be represented by different colors and maps for each month could be a colorful representation of the information graphed on the student's charts.

AIR QUALITY DATA SHEET

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
AIR COMPLIANCE/MONITORING
1982 OZONE LEVELS

Average of Daily Maximum Hourly Levels in PPM*

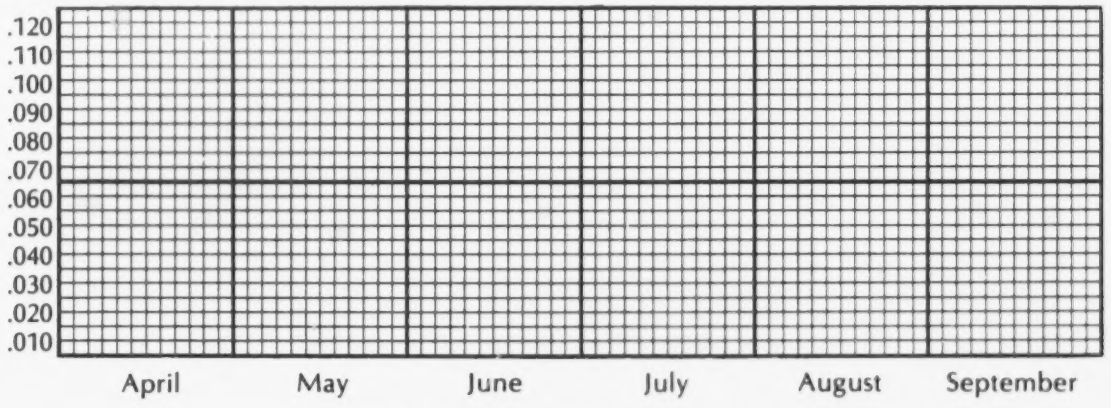
Site	April	May	June	July	August	September
New Haven	.051	.058	.058	.085	.060	.047
Madison	--	.059	.065	.097	.080	.064
New Britain	.071	.072	.069	.089	.073	.054
Middletown	.060	.069	.076	.104	.074	.070
Groton	.055	.076	.070	.105	.082	.068
Greenwich	.062	.080	.068	.102	.074	.063
East Hartford	.051	.056	.061	.075	.060	.046
Danbury	.060	.063	.066	.094	.067	.059
Bridgeport	.046	.059	.060	.090	.070	.052
Stratford	.060	.077	.079	.124	.090	.071
Stafford	--	.076	.074	.096	.071	.060

* This value is derived in the following manner: An ozone monitor is located at each of the 11 sites. Ozone levels are recorded hourly for a 24-hour period. The highest hourly ozone level for the day is taken for each day of the month. These numbers are then added and divided by the number of days in the month to yield the average for that month. The values are given in parts per million by volume.

Sample Graph

The following graph was generated by averaging the data for all of the monitoring sites on the Air Quality Data Sheet. You may wish to allow students to choose certain areas of the state to concentrate on in order to see if there were any geographic differences.

Ozone in ppm

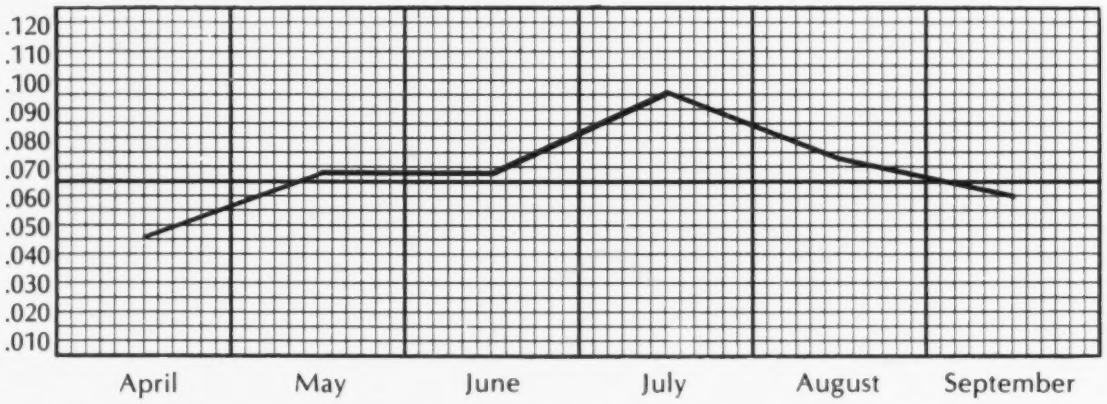


1982 Summer Months

Sample Graph

The following graph was generated by averaging the data for all of the monitoring sites on the Air Quality Data Sheet. You may wish to allow students to choose certain areas of the state to concentrate on in order to see if there were any geographic differences.

Ozone in ppm



1982 Summer Months

Connecticut's Air Quality Index

Objective

Students will be able to chart the number of days which exceed the federal health standard for ozone air pollution at the 11 monitoring sites in Connecticut during the previous summer (April 15- September 15)

Time

2-3 days

Materials

American Lung Association of Connecticut (ALAC) pamphlet entitled, "Connecticut's Air Quality Index and What It Means To You".
Graph Paper
Colored pens/pencils

Procedure

Students will read and discuss ALAC's pamphlet entitled "Connecticut's Air Quality Index and What It Means To You".

One student in the class will volunteer or be assigned the task of contacting the Public Participation Coordinator of the Air Compliance Unit at the Connecticut Department of Environmental Protection (DEP) (ConnDEP) (203) 566-2268, and set up a day and time for 3 or 4 of his/her classmates to visit the ConnDEP office in Hartford.

These 3 or 4 students will tour the Conn. DEP Air Compliance Unit and then transcribe the daily high levels of ozone recorded at the monitoring locations closest to their school for the previous summer.

The entire class will be divided into groups to chart these ozone readings Each group will chart periods of time ranging from two to four weeks.

Each group of students will identify these in the selected period and review the impact of such value on the respiratory health of Connecticut residents -- both the general population and those individuals considered at "high risk".

Related Activities

Design a bulletin board highlighting the Air Quality Index as well as a description of the air pollutants which exceed federal air quality standards in Connecticut.

Acid Rain - Damage and Economic Considerations

Objective

Students will be able to discuss the effects of air pollution on property and consider the economic consequences of these effects. In this activity students investigate the effects of an artificial acid rain -- made from sulfuric acid -- on some common household fabrics.

Time

One week

Materials

135mm cardboard slide mounts. These are used as fabric holders. A teacher who did this unit substituted petri plates.
Fabric: good quality (15 denier) nylon hose cut to fit the opening of the slide mount. You may have to purchase the nylon hose because nylon has been displaced by other hosiery materials. Blue jean material and sneaker canvas are also good materials to use.
Masking Tape
Scissors
Microscope Slides
Droppers/Dropper Bottles
Prepared Acid Stock Solutions

Procedure

Pre-Experiment

Indicate to the students that they will be conducting experiments to observe the effects of acidic solutions on a variety of materials. (This is supposed to simulate acid precipitation and show the damages that may result from it).

Before beginning the experiment initiate a discussion about the following considerations.

What variables will be relevant to the experiment? (Time, type, and color of the material, strength of acidic solution, etc.).

How will we measure these variables?

When will we measure these variables?

Next: Allow students to develop a hypothesis to predict the outcome of their experiments. Have students record this for themselves.

Acidic Solutions: A Recipe

pH 1	Add 5.5 ml of concentrated sulfuric acid to 94.5 ml of distilled water
pH 2	Add 10ml of pH 1 solution to 90 ml of distilled water
pH 3.7	Add 10 ml of pH 2.5 solution to 90 ml of distilled water
pH 4.2	Add 40 ml of pH 3.7 solution to 50 ml of distilled water
pH 6.4	Add 10 ml of pH 3.7 solution to 90 ml of distilled water

Control Distilled Water -- Determine pH.

Label the stock solution with symbols (○ , △ , □ , etc.) or letters (A, E, M, etc.) rather than with the known pH readings to reduce observer bias. Be sure to keep a record of the pH the various symbols represent.

Experiment

Students may work in groups, with each group experimenting on a different combination of materials.

The following instructions should be given:

1. Cut 6 pieces of material slightly larger than the slight mount opening.

2. Stretch the material over the slide mount and fasten with masking tape.

3. Label the slide mounts with the symbol of the solution that you will be testing on it.

4. Set each slide mount, label side up, on top of a microscope slide so that any excess acid will be caught.

5. Place 1 drop of the appropriate acid solution on each sampler. Be sure the label of the solution matches the label on the slide.

6. Observe the sample for 1 week. When the drop dries up or disappears, place another at the same location.

7. Observe the samples daily and record any changes that you notice. (Record this information in the format that was agreed upon in your class discussion prior to the experiment).

8. At the end of one week, organize your findings into a table or chart which clearly shows what you observed.

Post Experiment

Discuss and share each group's observations. Discuss the following:

How did the results compare with your hypothesis?

Were the results consistent?

Which acid do you think was the strongest? Weakest? Why?

Did you note any particularly interesting observations?

Why did the experiment turn out the way it did?

What kinds of damage do you think acid rain might cause in our environment?

How might we prevent it?

Follow-up

Read this excerpt from the 1982 Buick Owners Manual.

NOTICE TO NEW BUICK OWNERS
REGARDING CHEMICAL PAINT SPOTTING

Buick believes that certain weather and atmospheric conditions may create a chemical fallout whereby certain airborne pollutants fall upon and attack vehicle paints. Occurrences have taken place, primarily in the northeastern seaboard area. The paint damage takes two forms: blotchy, ringlet-shaped discolorations, and small irregular dark spots etched into the paint surface.

Paint spotting as a result of the fallout is not related to a defect in paint materials or workmanship. For this reason, the claims arising from this condition are not considered to be warranty-related. Neverless, because Buick shares the pride which our owners take in preserving and maintaining the appearance of their vehicles, Buick has authorized its dealers to repair, at no charge to the owner, the surfaces of new vehicles damaged by this fallout condition within 12 months or 12,000 miles (20,000 kilometers) of purchase, whichever comes first.

What does this mean?

Does your evidence back this up?

Have you ever observed damage like this on cars?

Does this company have a valid point?

What kind of experiment would you design to test this theory?

CULMINATING ACTIVITY
THE ROLE OF THE COMMUNITY*

Objective

Each student, through research in preparation to assume a role within the community, will be able to synthesize and apply the concepts presented in this Unit.

Time

2-5 days

Materials

Prepared cards listing various roles within a community such as:

- industry representative (personnel director, public relations)
- town government official (Mayor, Council member)
- environmental groups
- farmer
- local business (grocery store owner, gasoline station, etc.)
- "high risk" individuals (elderly, lung disease sufferer, etc.)
- other members of the public

Graphs, maps, etc., generated as a result of completing some or all of the following activities.

Air Pollution Mapping
Particulate Trap
Lake Acidity
Health Effects of Air Pollution
Air Pollution Graphing
Connecticut's Air Pollution Index

* This activity presents only one of a great many possible situations for students to role-play. You may wish to modify the situation for your classes or you may want to have your students help.

Procedure

Set up an imaginary community. The community should have industrial, commercial, residential, cultural and recreational areas. Use information gained through reading "The Air We Breathe" and completing the activities previously listed to supply air quality data for the town. Given the situation, the students will be responsible for planning a clean air strategy for the "community". Using their maps and graphs, students should be aware of which pollutants are most prevalent in their "community".

To set up a hypothetical situation with your class, a "situation" for a public meeting should be devised. One possibility would be the following:

A local newspaper has printed a story on the application of a local business to expand its manufacturing operations. The expansion will mean additional personnel, thus additional jobs, housing, and traffic, and the associated air quality concerns. A public meeting is then called so that "local officials" can formulate a plan regarding the manufacturer's request and public concern.

Students will choose or be assigned a role and then gather information that would be pertinent to their role. The information that they gather will be used to allow them to evaluate the situation from a particular perspective and then to form a position, which they will present at the hearing.

SECTION 4

WHERE DO WE GO FROM HERE?

RESOURCES

The following people will be happy to give you further information on air pollution related to pictures. Please note the areas of specialization.

Air Pollution Information -

Maureen Plourd
Connecticut Department of Environmental Protection
Air Compliance Unit
165 Capitol Avenue
Hartford, CT 06106
Telephone: 566-7102

Auto Emissions Testing Unit -

Diane Putnam
Connecticut Vehicle Inspection Program
1 Corporate Drive
Windsor Locks, CT
Telephone: 1-800-842-2000

Lung Health Information -

Elizabeth Nord
American Lung Association of Connecticut
45 Ash Street
East Hartford, CT
Telephone: 289-5401

Natural Resources Information -

Tina Delaney
Connecticut Department of Environmental Protection
Information and Education Unit
165 Capitol Avenue
Hartford, CT 06106
Telephone: 566-8108

Acid Rain Testing Network for Students -

Donna Rand
Talcott Mountain Academy
Montevideo Drive
Avon, CT
Telephone: 677-0035

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For Teachers:

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Commoner, Barry, *The Closing Circle; Nature, Man, and Technology*; NY, Bantam, 1974.

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For Students:

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SECTION 5

CONNECTICUT'S AIR POLLUTION EMERGENCY PLAN

Introduction

The Air Pollution Emergency Plan provides the basis for taking action to prevent air pollution concentrations from reaching levels which could endanger or cause significant harm to the public health, or to abate such concentrations should they occur.

The air quality in all areas of the State frequently does not meet the quality prescribed by ambient air quality standards applicable in Connecticut. A potential exists for air pollution in these areas to reach concentrations at which emergency actions are necessary to protect the public health. The Plan is applicable in these areas.

Episode Stages And Air Pollution Disasters

Listed below in order of increasing air pollution severity are the episode stages at which specific actions are required.

A Stage 1 Episode

A Stage 1 Episode is declared when the concentration of pollutants specified for this stage is predicted or reached. Persons with respiratory or coronary artery disease should be notified to take precautions against exposure. Schools should be notified so they can curtail students' participation in strenuous activities. First steps in abatement action plans shall be undertaken.

B Stage 2 Episode

A Stage 2 Episode is declared when the concentration of pollutants specified for this stage is predicted or reached. Abatement actions shall be taken with a minimum of delay to reduce the concentration of the pollutant at issue.

This is an intermediate stage. Abatement actions needed will vary depending on circumstances; e.g., maximum concentrations and duration.

C Stage 3 Episode

A Stage 3 Episode is declared when the conditions specified for this stage are predicted or reached. Extensive actions shall be taken to prevent exposure of people to pollutant concentrations of the indicated levels.

D Air Pollution State of Emergency

When it is determined by medical authorities or local officials that a substantial number of persons are suffering or are likely to suffer incapacitating effects from air pollution, regardless of measured pollutant concentrations, and analysis of meteorological and air quality data by the State DEP indicates that the condition is likely to continue, or recur, the Commissionere of DEP shall confer with the Director of the Office of Civil Preparedness along with the Commissioner of the State Department of Health Services and they shall jointly recommend to the Governor that an air pollution State of Emergency be declared.

E Episode Termination

An Episode is terminated whenever the concentration of the pollutant(s) which causes the declaration of such Episode has been verified to have fallen below the criteria level for the declaration of the Episode, and analysis of meteorological and air quality data indicates that the pollution concentration is expected to decrease.

ACTION FOR AIR POLLUTION STATE OF EMERGENCY

A. Administrative Actions

1. The Governor, or designee will anounce that an Air Pollution State of Emergency exists in a specific area.

2. The Governor, or designee will issue orders and regulations to reduce the health hazard and to implement appropriate abatement actions.

3. Warnings will be disseminated throughout the affected area, using all available public broadcast facilities. Warning information shall include the identification of the population groups most subject to harm, the air quality conditions, recommend health protection measures and abatement actions ordered by the Governor such as given in the Abatement Actions Section, below, and in Table (119).

B. Abatement Actions

Note: Abatement actions are examples , some of which may be counter-productive if taken inappropriately. Selected actions appropriate to the episode will be taken as necessary.

1. Close admission to all recreation facilities, sporting events, and scheduled entertainment, except motion picture theaters equipped with air conditioning in the receptor areas.

2. Close offices and retail and commercial operations with more than 50 employees. All other businesses shall respond to direct instructions from the Air Pollution Control Officer regarding opening opening or closure.

3. Close schools and colleges.

(Closure of facilities in 1, 2, and 3, is required only for disasters that are predicted to occur the next day. For disasters declared during the day, the facilities are to remain open, solely for serving the people within, if such people are ordered to remain).

4. Request that the use of electrical power be minimized except for air conditioning and health and safety purposes.

5. Curtail fuel combustion at electrical utilities to the maximum practicable extent, and seek power from sources outside the affected region.

6. Suspend activities, such as roofing, asphalt paving and surface coating where the use of large quantities of volatile organic material is involved.

7. Ban the operation of motor vehicles except emergency and health care vehicles, vehicles used for the transportation of people seeking medical assistance and vehicles declared exempt by the State Office of Civil Preparedness. In accomplishing this action, the Governor may call upon the Departments of the State Government to take such actions as necessary.

8. Ban sale of gasoline except to vehicles listed in above.

9. Suspend manufacturing and other pollution generating activities.

10. Impose curfew.

11. Evacuate specific areas.

EPISODE ACTIONS

A. Advisory of High Air Pollution Potential

Upon determination that a high potential for deteriorating air quality exists in an Air Quality Control Region as a result of a DEP analysis, the State Office of Civil Preparedness shall inform all Air Quality Control Regions of this condition. The operators of the monitoring stations shall be alerted to the potential by the appropriate DEP personnel.

B. Stage 1.

The following general actions shall be taken by DEP in the affected area upon the declaration of this stage:

1. Issue health warning, in accordance with Table (119), for sensitive persons in receptor areas.

2. Advise schools that strenuous activities by students must be discontinued. For episodes caused exclusively by ozone, this action may be limited to outdoor activities.

3. Notify officials, news media and organizations listed in Sub-Section (F) of previous section (i.e., Basic Program for Administration of Emergency Program.

4. Abatement Actions

   a. Initiate actions to reduce vehicular traffic, including carpooling, appropriate to the episode.

   b. If a sulfur oxide episode is declared request specific sources of sulfur oxides to reduce emissions.

C. Stage 2

The following general actions shall be taken by DEP in the affected area upon the declaration of this stage:

1. Issue health warning, in accordance with Table (119), to sensitive persons and those displaying reaction symptoms.

2. Advise suspension of programs which involve physical exertion by participants. Such programs which are for adult participants in scheduled athletic events with paid attendance are excepted.

3. Administrative Actions

   a. Officials, news media and organizations listed in Sub-Section (F) of previous section shall be notified.

   b. Meteorological and air quality data shall be continuosly monitored and evaluated until the episode is terminated.

4. Abatement Actions

a. Burning of combustible refuse at any location within the affected area shall be prohibited.

b. The traffic curtailment plan, appropriate to the episode, shall be implemented. Such plans shall include extensive carpooling or use of mass transportation by the public.

c. The DEP stationary source curtailment plans, appropriate to the episode shall be implemented. Affected industries shall be advised to prepare for possible shutdown.

d. Carbon Monoxide - If the occurrence of this stage for carbon monoxide is determined to have been due to traffic congestion in a specific area, measures shall be taken to reduce traffic congestion in that area. If traffic is at a standstill motorists shall be advised, where appropriate and when approved by local law enforcement officials, to turn off engines.

D. Stage 3.

The following general actions shall be taken by DEP in the affected area upon declaration of this stage:

1. Warnings shall be issued describing protective measures to be taken in accordance with Table (119), including identification of population groups most subject to harm and identification of the type of facilities where persons may be least subjected to exposure.

2. Administrative Actions

a. Notify officials, news media, and organizations listed in Sub-Section (F) of previous section.

b. The State Office of Civil Preparedness in conjunction with the DEP and State Health Department shall evaluate actions that have been taken and jointly advise the Governor of the conditions.

c. The source inspection plans shall be implemented. DEP shall be responsible for assuring that specified sources are, to the extent feasible, inspected during an episode.

3. Abatement Actions

a. The traffic curtailment plan, appropriate to the episode, shall be implemented. Emergency carpooling or use of mass transportation by the public shall be required.

b. The DEP stationary source curtailment plan, appropriate to the episode, shall be implemented.

E. Air Pollution State of Emergency

If the Governor declares an Air Pollution State of Emergency, the Governor will order the institution of any health protection and abatement actions considered appropriate. The S.O.C.P. will be the lead agency in this situation. Examples of such abatement action are given in Table (120).

Table (120)

SELF HELP FOR AIR POLLUTION EPISODES

The following actions are recommended to be taken by:

Sensitive persons with chronic lung disease or asthma, the elderly, the chronically ill and the excersing young at Stages 1, 2, and 3.

Healthy adults who feel effects at Stages 1, 2, and 3.

The general public at Stage 3.

1. AVOID STRENUOUS OUTDOOR PHYSICAL ACTIVITY (athletic activities, jogging, etc.), during an episode. Avoid exertion or excitement which increases your breathing rate and the body's oxygen needs. Plan other diverting activity for the young.

2. REMAIN INDOORS until the episode is terminated. Keep doors and windows closed if possible. (Indoor concentrations of ozone may be about one half of the outdoor levels). Use your air conditioner if you have one, to recirculate indoor air and keep cool. High temperatures may add stress to the pollutant effects. An activated charcoal system can further reduce ozone levels.

3. DO NOT SMOKE (and avoid places where others are smoking). Pollutants from smoking make the health challenge worse.

4. AVOID AEROSOLS, DUSTS, FUMES, AND OTHER IRRITANTS. Reduce to a minimum domestic activities, cooking, hobbies or occupations which produce them.

5. AVOID TRAFFIC CONGESTED AREAS where pollutants are being generated, if you must be outside.

6. AVOID CONTACT with persons suffering from respiratory infections.

7. PLAN YOUR ACTIVITIES. During air pollution seasons, listen to forecasts and postpone unnecessary activities on "episode" days. Most "peak values" of ozone occur between mid-morning and late afternoon. Use other hours for your exercise and other outdoor activities. Obtain sufficient rest and sleep.

8. EXPECT ONSET OR INCREASING SEVERITY OF SYMPTOMS with Stage 2 or Stage 3 episodes (coughing, wheezing, phlegm, shortness of breath, chest discomfort, pain).

   Follow your physician's treatment advice or consult him again. Know what medication to uise for specific symptoms. Maintain adequate fluid intake.

   Know the location of your nearest emergency treatment facility in case your doctor advises increased therapy (ventilation assistance, oxygen treatment, etc.).

SECTION 6

EVALUATION FORMS

Individual Activity Evaluation Forms
(10 copies)

"The Air We Breathe" Evaluation Form

TEACHER BACKGROUND

Upon completion of the evaluation forms, please send them to:

Ms Maureen Plourd
Air Compliance Unit
Connecticut Department of
Environmental Protection
State Office Building
Room 138
Hartford, CT 06106

INDIVIDUAL ACTIVITY EVALUATION

Title of Activity:

Grade:

Number of Students:

How long did this activity take? (teacher preparation, actual classroom time).

Was the activity successful? (enlightening, feasible, enjoyable).

What did you like about this activity?

Would you suggest any changes? (If so, what?).

Additional Comments:

"THE AIR WE BREATHE" Evaluation Form

Grade:

Number of Students:

Please describe any previous exposure to this subject that you or your students may have had.

How long did you spend on this Unit? In what modality (once a week for 5 weeks, ½ hour each day for 2 weeks, etc.):

Which activities did you use? Which worked best? Explain:

Was the arrangement and format of the Unit suitable for your needs?

Were explanations and instructions adequate?

Were the materials well suited for your grade level? Explain:

Were posters, handouts, etc., helpful and appropriate?

What were the five questions that students asked most frequently?